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Procedures to Estimate Airport Residential Relocation Costs

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Silver Spring, MD

Prepared for

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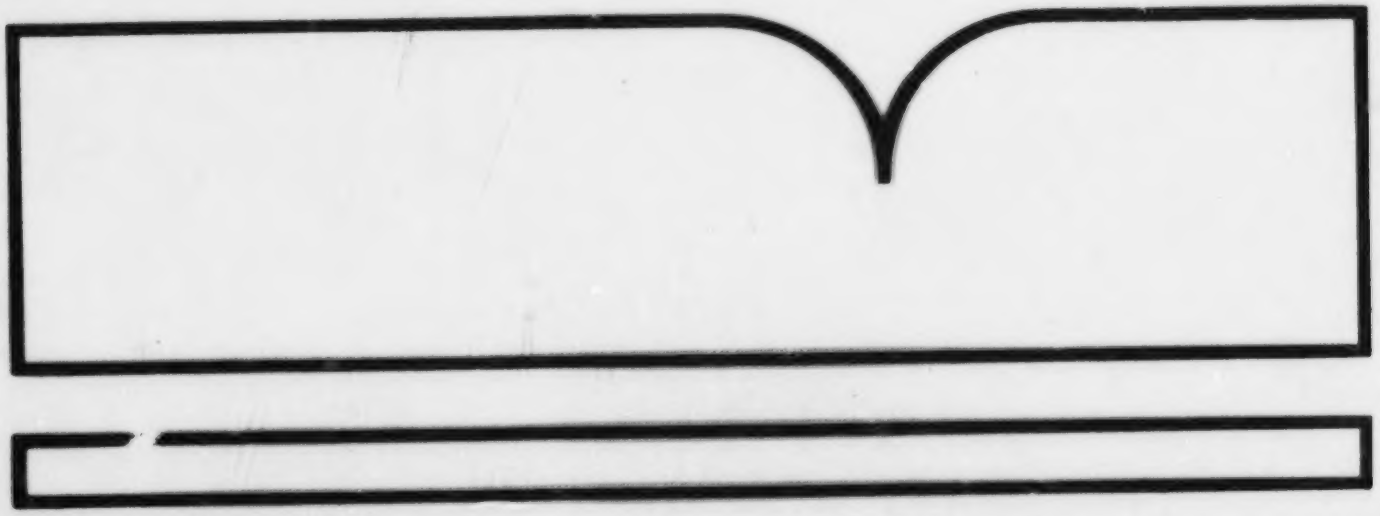

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PROCEDURES TO ESTIMATE AIRPORT RESIDENTIAL RELOCATION COSTS

APRIL 1981

OFFICE OF NOISE ABATEMENT AND CONTROL
U.S. ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

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The cost of relocating private residences exposed to excessive aviation noise levels at the nation's airports is a major factor in determining the viability of a comprehensive airport relocation and soundproofing program. The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 is reviewed to determine applicability to a relocation program and to define airport-specific relocation cases and costs. Procedures are provided for: (1) developing a well-defined set of cases for which relocation costs may be estimated; (2) determining the costs in current dollars for each expense item in each relocation case; and (3) determining the frequency of occurrence for each case as applied to specific airports. Total costs for all cases for a hypothetical airport relocation effort are provided. Supporting data and equations used are presented.

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APRIL 1981

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I. INTRODUCTION

Considerable progress has been made to reduce excessive aviation noise levels at the nation's air carrier airports. Quieter aircraft are now operating in the U.S. fleet, adjusted flight procedures result in aircraft being flown in a quieter manner, and other noise abatement actions are being examined or carried out by airport proprietors and local officials at many airports.

These measures are important elements in achieving the national goals of aviation noise abatement to confine severe outdoor aircraft noise levels greater than L_{dn} dB* to the area included within the airport boundary, or to areas which are otherwise being used in a manner compatible with this level of noise and to reduce substantially the number and extent of areas receiving noise-exposure levels that interfere with human activity. These measures alone, however, will not resolve the noise problem at many airports. What is needed to address residual impact (i.e., those remaining after reasonable noise control alternatives are implemented) is a concerted program of relocating and soundproofing private residences exposed to aircraft noise levels exceeding L_{dn} 75 dB and 65 dB, respectively.

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*The generally accepted measure of community noise exposure is the outdoor average day/night level in decibles, denoted L_{dn}.

PURPOSE OF STUDY

The scope and content of a broad airport Soundproofing and Relocation Program are being examined in a series of related studies sponsored by the Environmental Protection Agency's Office of Noise Abatement and Control. A major factor in determining the viability of such a program is the cost of relocating and soundproofing affected residences. The purposes of this study are to: (1) develop a well-defined set of cases for which relocation costs may be estimated; (2) determine the costs in current dollars for each expense item in each relocation case; and (3) develop a procedure for determining the frequency of occurence for each case as applied to specified airports.

REPORT OVERVIEW

The findings of this study are presented in Chapters II, III and IV.

Chapter II

In this chapter, the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 is reviewed to determine circumstances in which the Act might be applicable to an airport Relocation and Soundproofing Program. The provisions of the Act are also used as a basis for defining relocation cases and costs in the chapters which follow.

Chapter III

This chapter defines a set of relocation cases, based on the provisions of the Relocation Act, for which relocation costs are estimated. The cases capture the major differences in total costs between rental and owner-occupied properties. Procedures also are developed for estimating the frequency of each defined case in the context of potential relocation efforts at a specific airport.

Chapter IV

Based on the case definition and frequency procedures presented in earlier chapters, estimates of the costs are presented in this chapter for: (1) cost elements comprising each discrete relocation case; and (2) total

costs for all cases for a hypothetical airport relocation effort. Supporting data and equations used are presented in appendices to this report.

It is emphasized here that the costing procedures developed in this report are applied to a hypothetical airport denoted "Anytown, U.S.A." Use of this airport is not intended to be representative of the total relocation costs a real airport might incur. Rather, the total costs result from a straight-forward application of case element and frequency data. The procedure may, however, be used to estimate relocation costs for real airports as data on residences within a L_{dn} 75 dB noise contour are available.

II. REVIEW OF UNIFORM RELOCATION ACT

Prior to passage of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, 42 U.S.C. 4601, in 1971, nearly all federally-assisted programs had differing and conflicting provisions for relocating displaced persons. The programs ranged from providing no assistance at all in some cases to providing liberal benefits and protection in others. These inequities created irritation and confusion in the affected communities. The Relocation Act was directed at resolving these inequities by establishing a uniform policy for the fair and equitable treatment of persons displaced as a result of Federal and federally-assisted programs. That is, the Act was to insure that displaced persons should not suffer disproportionate injuries as a result of programs designed for the benefit of the public as a whole.

We discuss below circumstances under which the Act may apply to a Relocation/Soundproofing Program. A summary of allowable costs under the Act is also presented.

APPLICABILITY OF THE ACT

An initial concern is whether the Relocation Act would apply to one of four broad strategies under which a comprehensive Relocation/Soundproofing Program to alleviate unacceptably high noise levels around the

nation's air carrier airports might be implemented. These strategies are that the program will be:

- Carried out individually by each airport
- Carried out by individual airports acting under a level of State control or guidance
- Carried out by individual airports acting under a level of control or guidance of a group of States
- Carried out by individual airports with the assistance and under the direction of the Federal Government.

Applicability centers around the meaning of Section 101(6) of the Act which defines "displaced person." It is this definition that governs eligibility for the several types of assistance available under the Act. Section 101(6) provides, as pertinent, that:

> The term "displaced person" means any person who...moves from real proprety, or moves his personal property from real property, as a result of acquisition of such real property, in whole or in part,...for a program or project undertaken by a Federal agency, or with Federal financial assistance;....

Section 108 of the Act extends relocation coverage to State agencies whenever such agency acquires real property"...at the request of a Federal agency for a Federal program or project..." In such instances, the acquisition for the purpose of the Act shall be deemed an acquisition by the cognizant Federal agency. A State agency is defined in Section 101(3) as:

> ...any department, agency, or instrumentality of a State or of a political subdivision of a State, or any department, agency, instrumentality of two or more States or two or more political subdivisions of a State or States.

Coverage of a displaced person thus requires that there be extant a clear Federal involvement (in the form of financial assistance or a program or project) and that the acquisition be undertaken directly by a Federal agency or through a political instrumentality of a State.

Federal Involvement

The Federal Government may be involved in the program under three broad mechanisms. The first is direct grants and loan guarantees to individual airports, such as those under the Federal Aviation Administration's Airport Development Aid Program (ADAP) or Federal-aid to Airport Program (FAAP) and under the Economic Development Administration's developmental grant and business loan programs. Even partial funding would bring the program under the first test of applicability of the Act as long as such funds are used specifically for the acquisition of relocated residences, see Rhodes v. Chicago, 516 F.2d 516 (7th Cir. 1975).

The second mechanism arises under the fourth relocation strategy whereby the overall program is under some degree of direct Federal Government direction or control. An example scenario would have noise charges collected by individual airports transferred to the Federal Government and then allocated to airport programs depending on their need. This hypothetical process is similar to the Highway Trust Fund which allocates funds to various State highway departments. As long as funds finance identified airport programs, the first test would be met.*

The final mechanism also comes under the fourth strategy. The Federal Government would possibly suggest standards and time limitations for program implementation, but would not be involved in allocating funds collected by individual airports as discussed in the case above. While a Federal "presence" would be extant, persons would not displaced as a result of a program or project undertaken by a Federal agency nor would Federal financial assistance be involved.

Implementing Organization

The character of the organization implementing a Relocation/Soundproofing Program is of prime importance in determining applicability of the

*A possible exception would be if the fund transfers were characterized as "block grants" with virtually no strings attached. This situation could be analogous to general revenue sharing funds allocated pursuant to the State and Local Fiscal Assistance Act of 1972, 31 U.S.C. 1221 et seq. These funds transfer have been held to be exempt from the Relocation Act because of the Act's requirements and the "no strings attached" intent of general revenue sharing, Goolsby v. Blumenthal, 581 F.2d 455, rev'd. on hearing en banc, 590 F.2d 1369 (5th Cir. 1979).

Relocation Act. Operating authority for the Nation's air carrier airports covers a wide range. For example, authority for 60 of the large, terminal city airports is vested in the following entities:

- Cities -- 13
- Local Authorities, Commissions and Boards -- 33
- States -- 1
- Parks/Port Authorities -- 9
- Regions -- 2
- Federal Government -- 1.

Thus, in the majority of instances the implementing organization would be a governmental body in a State or group of States. However, it is possible that certain programs may be carried out by private organizations (i.e. where the airport is privately owned). In such instances, the courts have generally held that dislocations by private entities are not within the purview of the Act even if pursuant to a Federal or federally-assisted program, Dawson v. HUD, 592 F.2d 1293 (5th Cir. 1979).

Program Application

From the above discussion it is evident that, while it is certainly possible that the Relocation Act could apply to airport-specific Relocation/ Soundproofing Programs, conclusions regarding the extent of its coverage are not possible at this time. For example, applicability would be fairly limited if programs were funded predominantly from user charges without allocation of such charges by the Federal Government. Much broader applicability, however, would be possible if airports made extensive use of Federal grant or loan assistance to totally or partially fund displacements.

We nevertheless believe the Act provides a useful basis from which discrete relocation cases and associated costs can be developed. This is the approach taken in the chapters which follow.

ALLOWABLE COSTS

Persons displaced under the Relocation Act are entitled to assistance and cost reimbursement in three categories as follows:

- Relocation assistance advisory services -- a program element funded by the relocation agency to provide general assistance to displaced persons.*
- Direct payments not subject to statutory limitations -- homeowners and tenants are entitled to reimbursement for actual reasonable moving expenses and homeowners are entitled to the fair market value for acquired property.
- Direct reimbursements subject to statutory limitations -- reasonable costs associated with securing replacement housing subject to a maximum of $15,000 for homeowners and 4,000 for tenants.

The basic cost elements of the three categories are summarized in Table 2.1 and are discussed in more detail later in this report.

*The majority of the Act's benefits accrue solely to "displaced persons" as defined earlier. However, section 205(a) extends the advisory service to "any person occupying property immediately adjacent to the real property acquired (who) is caused substantial economic injury because of the acquisition...."

TABLE 2.1

ASSISTANCE AND COST REIMBURSEMENT ITEMS UNDER THE RELOCATION ACT

DESCRIPTION	ACT REFERENCE	COMMENTS
ADVISORY SERVICES	Sec. 205	• Available to displaced persons and adjacent property owners • Covers property appraisal, locating replacement housing, agency administrative expenses, etc.
DIRECT PAYMENTS WITH NO LIMITATIONS		
• Moving expenses	Sec. 202	• Actual, reasonable expenses • Moving ($300) and dislocation ($200) expenses allowance in lieu of actual expenses
• Purchase Price	Sec. 203	• Fair Market Value (FMV) of dwelling acquired • Limited to homeowners.
DIRECT PAYMENTS WITH LIMITATIONS		
• Replacement Costs (Homeowners)	Sec. 203	• Difference between purchase price of replacement dwelling and FMV of dwelling acquired

TABLE 2.1 (cont.)

DESCRIPTION	ACT REFERENCE	COMMENTS
• Increased Interest Cost	Sec. 203	• Interest differential between acquired and replacement dwelling (homeowners with bona fide mortgage).
• Closing Cost	Sec. 203	• Reasonable expenses for evidence of title, recording fees, and closing costs related to replacement dwelling (homeowners only).
• Downpayment	Sec. 204	• Tenants purchasing replacement housing (not to exceed $4,000, with displaced person matching payments in excess of $2,000).
• Replacement Costs (Tenants)	Sec. 204	• Lease or rental differential between acquired and replacement rental dwelling.
• Income Foregone	Sec. 202	• Compensation to owners of rental property, subject to $10,000 maximum.

III. RELOCATION CASE DEFINITION AND FREQUENCY

This chapter defines a set of distinct relocation cases based on the provisions of the Relocation Act for which relocation costs are estimated. The cases capture the major differences in total costs between rental and owner properties and enable ready comparison of specific cost elements in each of the cases. Case development is also geared to subsequent analysis of total relocation costs associated with a national Relocation/Soundproofing Program aimed at providing relief to residences most severely affected by air carrier noise at the nation's airports.

DEFINITION OF RELOCATION CASES

Four relocation cases are defined as follows:

- Case A -- Renters who remain renters
- Case B -- Renters who become homeowners
- Case C -- Rental property to be purchased
- Case D -- Owner-occupied units to be purchased.

Relocation cost elements applicable to each case are summarized in Table 3.1. The cases are discussed below.

TABLE 3.1
COST ELEMENTS AND RELOCATION CASES

COST ELEMENT	RELOCATION CASE*			
	A	B	C	D
Advisory Service Cost	X	X	X	X
Moving Cost	X	X		X
Purchase Price			X	X
Replacement Cost	X			X
Increased Interest Cost				X
Closing Cost				X
Downpayment		X		
Foregone Earnings			X	

*Relocation Cases

A. Renters Who Remain Renters

B. Renters Who Become Homeowners

C. Rental Property to be Purchased

D. Owner-Occupied Units to be Purchased

Renters Who Remain Renters

The first case is comprised of existing renters who elect to remain renters. Section 204 of the Act provides for payments to tenants in displaced dwellings who were tenants for at least 90 days prior to the initiation of negotiations for acquisition of such dwellings. These persons are entitled to a rent supplement for up to four years in the event that the rent in a replacement unit exceeds the rent the displaced person is paying at the time of relocation. Such payments may not exceed $4,000. Renters are also entitled to the advisory services of the local relocation agency (Section 205) and to re-imbursement for moving expenses.

Renters Who Become Homeowners

The Relocation Act recognizes that renters who are dislocated may want to purchase their own homes as an option to moving to another rental property. These people are entitled to the advisory services of the relocation agency and re-imbursement for moving expenses. In addition, there is a special provision in Section 205 of the Relocation Act making money available for downpayments (including incidential expenses) on replacement homes. Such payments shall not exceed $4,000, except that the renter must match any amount paid in excess of $2,000.

Rental Property To Be Purchased

The third location case is made up of rental property to be purchased. Onwers of these properties are entitled to the fair market value of their rental units. Because landlords typically suffer a disruption of their business operations and loose their existing tenants in the course of the relocation, they may elect to accept a compensatory payment to cover the cost of their foregone earnings from the rental units. Such payments are distinct from payments to dislocated renters addressed under the prior two cases.

It is interesting to note that other businesses may also be disrupted by the relocation of their existing patronage (e.g. neighborhood grocery stores). The owners of these businesses are also entitled to a compensatory payment.

Owner-Occupied Units To Be Purchased

The fourth and most complex relocation case is made up of owner-occupied units to be purchased. It is assumed that the owners of these units will remain homeowners even though some will, in fact, choose to become renters. This simplifying assumption may result in a slight overestimate of the relocation cost of homeowners.

Relocated homeowners are entitled to the services of the relocation agency and re-imbursement for moving costs. The homeowners are also entitled to the purchase price (at fair market value) of their homes, a supplemental payment over and above the fair market value in the event that the purchase price of the comparable replacement home exceeds the fair market value of their homes in the area exposed to excessive airport noise. They are also entitled to compensation for any increased interest costs resulting from liquidating the original mortgage and taking out a new mortgage on the replacement dwelling at the current mortgage interest rate, and any closing costs involved in the purchase of the replacement home.

The most complex cost element is the increased interest cost applying to homeowners. A special procedure is developed below to account for the fact that homes to be relocated would have been purchased over many years with a range of interest rates.

CASE FREQUENCIES

In this section procedures are developed for estimating the frequency of each case identified previously. The frequencies are estimated for the year 1979. In the section following this one, estimates are provided of the dollar amount of each cost element identified in Table 3.1. This, together with the case frequencies, makes it possible to estimate the total cost of the relocation program.

The procedures developed here for estimating case frequencies rely almost exclusively on the Demographic Profile Reports developed by CACI, Inc., under the sponsorship of the National Aeronautics and Space Administration (NASA). CACI uses its SITE II data base to summarize a variety of demographic data (derived from the U.S. Census) for areas contained within concentric

circles around the Nation's airports. For purposes of this study, the profile for a circle with a radius of three miles located in "Anytown, U.S.A." is employed. An abstract of the profile is presented in Table 3.2. This excercise is carried out assuming that all households residing within the circle are relocated.

The emphasis here is on the procedures used to derive the estimates. The actual numbers presented are of less concern. They result from the straightforward application of the procedures to the dummy data for "Anytown" and are provided for illustrative purposes only. Note that "Anytown" is not intended to represent the relocation area around a representative airport and should not be interpreted as such. The relocation cost estimates presented in this report are in no way indicative of the actual relocation costs at any of the Nation's airports.

Frequencies in 1970 and Development of Updating Parameters

The 1970 Demographic Profile Report contains frequency data on the numbers of households, renters, homeowners, and housing units as shown in Table 3.2. The profile also contains information on the stock of structures from which reasonable estimates can be made of the stock of rental units and rental properties. These supplementary frequency estimates also appear in Table 3.3.* The estimating procedures used to generate the supplement are described in detail in Appendix A.

From the frequency data appearing in Table 3.3 ratios are formed which serve as parameters in the updating procedures. These parameters appear in Table 3.4. Two additional parameters appear at the end of Table 3.4 which are not derived from Table 3.3. These state that eighty-four percent of all renters remain renters and sixteen percent become homeowners. These ratios are based on the recent experience of the Federal Highway Administration, an agency of the Federal Government with considerable relocation experience. The information provided by the Federal Highway Administration is listed in Appendix B.

Most of the ratios are self-explanatory but Ratios (1) and (4) require some discussion. Ratio (1) indicates that the number of occupied housing units is less than the number of households. This discrepancy is

*Frequency data is also provided for the year 1979. The procedure to develop the 1979 estimates is presented in Table 3.5.

TABLE 3.2

ABSTRACT OF DEMOGRAPHIC PROFILE REPORT FOR A CIRCLE SIX MILES IN DIAMETER IN "ANYTOWN, U.S.A."

HOUSEHOLDS

1970	7549
1980	7617

SELECTED 1970 CENSUS DATA ON HOUSING

Occupied Rental Units	4152
Average Rent	$149/Month
Owner-Occupied Units	3275
Average Home Value	$32,903

STRUCTURES	
Units in Structure	Number of Units
1	4086
2	81
3-4	305
5-9	579
10-49	1445
50+	1055
Mobile	7

Total (Excluding mobile)	7,551

TABLE 3.3
FREQUENCY DATA FOR "ANYTOWN, U.S.A."

		1970	1979****
(1)	Number of Households	7,549	7,610.2
(2)	Number of Occupied Rental Units (Renters)	4,152	4,185.0
(3)	Number of Owner Occupied Units (Homeowners)	3,275	3,302.0
(4)	Number of Occupied Housing Units	7,427*	7,487.0
(5)	Total Number of Housing Units	7,551**	7,612.0
	Supplementary Estimates***		
(6)	Rental Units	4,276	4,310.0
(7)	Rental Properties	1,084	1,093.0
(8)	Single-Unit Rental Properties	811	N/A
(9)	Multi-Unit Rental Properties	273	N/A

*(4) = (2) + (3)
**Excludes seven mobile homes
***See Appendix A
****See Table 3.5

TABLE 3.4

UPDATING PARAMETERS FOR "ANYTOWN, U.S.A."

Updating Parameters*		
(1)	Occupied Units/Households	0.9838
(2)	Renters/Occupied Units	0.5590
(3)	Homeowners/Occupied Units	0.4410
(4)	Housing Units/Occupied Units	1.0167
(5)	Rental Units/Rental Properties	3.9446
(6)	Single-Unit Rental Properties/Rental Properties	0.7482
(7)	Multi-Unit Rental Properties/Rental Properties	0.2518
Supplementary Parameters**		
(8)	Renters Remaining Renters/Renters	0.84
(9)	Renters Becoming Homeowners/Renters	0.16

*Derived from Table 3.3
**See Appendix B

TABLE 3.5

ESTIMATES OF CASE FREQUENCIES IN 1979*
(See Table 3.4)

A. Relations:

1. Occupied Units = Ratio (1) times Number of Households
2. Renters = Ratio (2) times Occupied Units
3. Case A, Renters Who Remain Renters = Ratio (8) times Renters
4. Case B, Renters Who Became Homeowners = Ratio (9) times Renters
5. Case D, Homeowners = Ratio (3) times Occupied Units
6. Housing Units = Ratio (4) times Occupied Units
7. Rental Units = Housing Units minus Homeowners**
8. Case C, Rental Properties = Rental Units divided by Ratio (5)

B. Procedures Applied to "Anytown, U.S.A.", Using Parameters Appearing in Table 3.4:

1. Occupied Units = 0.9838 x 7610.2 = 7487
2. Renters = 0.5590 x 7487 = 4185
3. Case A = 0.84 x 4185 = 3516
4. Case B = 0.16 x 4185 = 670
5. Case D = 0.4410 x 7487 = 3302
6. Housing Units = 1.0167 x 7487 = 7612
7. Rental Units = 7612 - 3302 = 4310
8. Case C = 4310 3.9446 = 1093

C. Summary of Case Frequencies for "Anytown"

Case A = 3516

Case B = 670

Case C = 1093

Case D = 3302

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*These relations are written in mathematical notation in Appendix C

**Assumes that all homeowners are in occupancy when negotiations for acquisition begin. It follows that all vacancies occur among rental units. The vacancy rate does, in fact, tend to be highest for rental units.

accounted for by the fact that a tiny fraction of households live in group quarters or in mobile homes. Ratio (4) indicates that the number of housing units is greater than the number of occupied units. The discrepancy is accounted for by vacancies.

By restricting this analysis to data provided in the Demographic Profile Report (see Table 3.2) and the Federal Highway Administration, information specific to "Anytown" on the post-1970 trends in rentals versus homeownership, in group living and mobile homes, and in the housing stock and vacancy rates is not available. Lacking site-specific information, we assume that the relationships which existed in 1970 provide a reasonable estimate of the relationships that pertain to the base year, 1979. Therefore, the ratios appearing in Table 3.4 serve as updating parameters.

Case Frequencies For Year 1970

Relocation case frequencies for the 1970 can be derived from straightforward application of the data presented in Tables 3.2 to 3.4. The procedure is as follows:

- Case A: Renters Who Remain Renters --

  ratio (8) from Table 3.4 times renters, or 4152 X 0.84 = 3,540

- Case B: Renters Who Become Homeowners --

  ratio (9) from Table 3.4 times renters, or 4152 X 0.16 = 664

- Case C: Rental Properties --

  row (8) from Table A.1, or 1084.4

- Case D: Homeowners --

  from Table 3.2, or 3275.

Note that should complete Demographic Profile Report updates be available for years other than 1970, the above procedure would be used rather than the updating process described below for year 1979.

Updating Procedures

The Demographic Profile Report shows the number of households in "Anytown" in 1980. Of all the frequency variables listed in Table 3.3, this

is the only one for which an update is available (see Table 3.2). Given 7,549 households in 1970 and 7,617 in 1980 it can be shown that the compound annual growth rate is 0.0897 percent per year, or less than one tenth of one percent per year. Using this compound annual rate, the number of households in the base year, 1979, is 7610.2. The formula used to calculate the compound annual growth rate appears in Appendix C.

Case Frequencies for Years Other Than 1970

The procedure to develop cases frequencies for years other than the base year is similar to that just described. It begins with an estimate of the total number of households in residence in the specified year. Once the number of households is determined, following the steps listed in Table 3.5 will yield the desired case frequencies for the specified year.

IV. RELOCATION COSTS

Estimates are presented in this chapter for cost elements comprising each relocation case and for total costs for a hypothetical airport relocation effort. The estimates are based on the case definition and frequency procedures developed in the prior chapter.

ELEMENT COSTS

Estimates are provided here of the dollar amount of each cost element identified in Table 3.1. The cost estimates are estimated for the base year 1979. Information provided by the Federal Highway Administration is used to measure advisory service costs, moving costs and closing costs in 1979. Figures provided by the Federal Highway Administration are rounded off the nearest one hundred dollars. The raw data appears in Appendix B.

Other cost elements are estimated by applying updating procedures to the 1970 Demographic Profile Report (see Table 3.2). As in the previous section, the emphasis is on the procedures used to estimate the cost elements rather than the numbers presented.

Each cost element listed in Table 3.1 is discussed in turn. The results are summarized in Table 4.4, which appears after the discussions.

Advisory Service Costs

Advisory service costs are costs incurred by the relocation agency. They cover such activities as appraisal, negotiations, relocation assistance and administration. They may also include the cost of locating and appraising three or more comparable replacement housing units for each unit to be vacated. This activity is recommended by the Relocation Act and is used to determine the reasonable cost of replacement housing and to provide the dislocated households with alternatives. The households may reject the alternatives and find own replacement housing but they will be subject to the "reasonable cost" estimates of the relocation agency.

In 1979, the service costs of relocation incurred by the Federal Highway Administration averaged $1,200 per case.

Moving Costs

Moving costs are incurred by all relocated households. Under the Relocation Act, households may be compensated for actual costs or may elect to receive a fixed allowance. Under the Act, all moves are local or treated as if they were local.* In 1979, eighty-four percent of all households relocated by the Department of Transportation chose to receive the moving allowance plus dislocation allowance totaling $500 per household or less. The remainder were compensated for actual costs which averaged $1,200 a household. The average moving cost per household in 1979 was approximately $500.

Purchase Price of Rental Property

Under the Relocation Act all owners who must vacate their dwellings are entitled to receive fair market value for their residential property. The procedures used in this section are presented in mathematical notation in Appendix D.

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*The Act covers only "reasonable expenses", and most agencies intrepret this as a move not exceeding 50 miles. A person moving more than 50 miles would have to absorb the extra costs associated with a long distance move.

The Demographic Profile Reports give the mean rent paid by tenants in 1970 and the mean value of owner-occupied units in 1970. For "Anytown, U.S.A.", the mean rent was $149 per month in 1970 (see Table 3.2). In the absence of information specific to changes in rents in "Anytown, U.S.A.," we assume that rents rise in accordance with national trends. National price indices for residential rents are presented in Table 4.1 and indicate that rents in 1979 were 1.6 times their 1970 levels. Application of this multiplier results in a mean rent of $238.40 per month in 1979.

From information on the monthly rental, an estimate of the fair market value of the typical rental property is derived. The formula used is:

$$(1) \qquad C = \frac{12(RU)}{i}$$

where: C = The fair market value of a typical rental property in a given year

R = The monthly rental income from a typical rental unit in that same year.

U = The average number of units per rental property.

i = The estimated mortgage interest rate in that year.

Equation (1) is a simplification of a complex relationship in that it ignores capital gains, depreciation, maintenance costs, taxes and anticipated changes in rents and interest rates. It is assumed that these complicating factors tend to offset one-another so that Equation (1) provides an estimate of the present value of rental property which is adequate for the purpose of making cost estimates.

The mean rent in 1979 is estimated to be $238.40 per month or $2,860.80 per year. In the previous section we estimated that there are 3.9446 units per rental property (see Table 3.3). Given four units per rental property, the total rental income per property is $11,284.71 per year in 1979. The estimated mortgage interest rate in 1979 is 9.54 percent. The method used to estimate the 1979 interest rate and the reason for using an

TABLE 4.1

CONSUMER PRICE INDEXES FOR RESIDENTIAL RENT AND HOME PURCHASE, 1965-1979

	Rent*		Home Purchase**	
YEAR	1970 = 1.0	1979 = 1.0	1970 = 1.0	1979 = 1.0
1965	0.88	0.55	0.82	0.43
1966	0.89	0.56	0.83	0.44
1967	0.91	0.57	0.85	0.45
1968	0.93	0.58	0.87	0.46
1969	0.96	0.60	0.93	0.49
1970	1.00	0.63	1.00	0.53
1971	1.05	0.66	1.05	0.56
1972	1.08	0.68	1.10	0.58
1973	1.13	0.71	1.12	0.59
1974	1.19	0.74	1.21	0.64
1975	1.25	0.78	1.36	0.72
1976	1.31	0.82	1.42	0.75
1977	1.39	0.87	1.52	0.80
1978	1.49	0.93	1.66	0.88
1979	1.60	1.00	1.89	1.00

*Source: Economic Report of the President, Transmitted to the Congress January 1980, Table B-49, page 259. Converted from 1968=100.0

**Source: Ibid, Table B-50, page 260. Converted from 1968=100.0

estimated rate rather than the actual rate are presented later in this report, in the section entitled "Increased Interest Cost." Applying the estimated interest rate of 9.54 percent to Equation (1) results in a fair market value of $118,288 for a typical rental property.

Purchase Price of Owner-Occupied Units

For "Anytown, U.S.A.", the mean value of owner-occupied homes in 1970 was $32,903. In the absence of information specific to "Anytown, U.S.A.", we assume that residential property values rise in accordance with national trends. National price indices specific to home purchases are shown in Table 4.1. They indicate that market prices in 1979 were 1.89 times their 1970 levels. Application of this multiplier results in a mean market value of $62,187 in 1979. (See Appendix D for equations).

A concept embodied in the Act in assessing fair market value warrants mention here. Secton 301 provides that "any decrease or increase in the fair market value of real property prior to the date of (property) valuation caused by the public improvement for which said property is acquired, or by the likelihood that the property would be acquired for such improvement, other than that due to physical deterioration within the reasonable control of the owner, will be discarded...." An example of this concept occurs when property is acquired for installation of a water and sewer system. Even though such a system could increase adjacent property values (e.g. allow the lifting of a sewer moritorium or allow greater density housing), such increase is excluded from fair market value determinations. Another example may arise when an airport manager may elect to relocate an area of residential housing and then sell the land for industrial or commercial uses compatible with high airport noise levels. The alternative uses may actually increase the assessed value of the acquired property. A converse situation would have the acquired property remain vacant with restrictions prohibiting any future private or public use of such land. This would most likely reduce the assessed value. These situations are avoided by relocation agencies by disregarding any potential change in value after acquisition.*

*Property owners are nonetheless entitled to fair market value based on the highest and best use of the land. Residential property may thus be valued based on an alternative commercial use, as long as such alternative use is predicated on developmental efforts exclusive of those related to an airport relocation program.

Replacement Cost

Relocated tenants and homeowners receive a payment to cover the increased rental or purchase price required to obtain comparable replacement housing in a quieter neighborhood. Evidence for a noise decrement in rents and property values and quantification of the decrement are presented in J. P. Nelson, "Airports and Property Values, A Survey of Recent Evidence." Nelson and other researchers have found that airports exert two distinct effects on residential land values: a depreciation effect due to aircraft noise and an appreciation effect due to accessibility to the airport.

The Relocation Act requires that replacement housing be equally accessible to places of employment. Since the airport is an employment center, we assume that the replacement housing is equally accessible to the airport so that the appreciation in residential property values due to access cancels out, leaving only the depreciation effect due to noise. Following Nelson and others, it is assumed that residential rents and property values decline by one half of one percent per decibel of noise exposure, holding distance to the airport constant. The conclusion from Nelson's survey of the literature appears in Appendix E. It is assumed that the typcial relocation is from an area exposed to L_{dn} 75 dB to one exposed to L_{dn} 55 dB. This relocation involves an incrase in rents and property values of ten percent (0.5 x 20). These noise levels were chosen because the noise contour is exposed to L_{dn} 75 dB at its parimeter where, presumably, most people live, and because the noise level at the new location, L_{dn} 55 dB, reflects a typical urban noise level in the general vicinity of an airport.

Under the Relocation Act tenants are eligible to a lump sum payment equal to four times the increase in their annual rent. The mean rent in 1979 is $238.40 per month or $2860.80 per year. The relocation involves an increase in rents of ten percent or $286.08 per year. Four times this is $1,144, the mean replacement cost for tenants.

The mean home value is $62,187. The relocation involves moving to a comparable house in a quieter neighborhood where homes cost ten percent more, or $68,406. The replacement cost is $6,219.* The procedures used in this section are presented in mathematical notation in Appendix D.

Increased Interest Cost

The increased interest cost occurs when the interest rate on the replacement mortgage exceeds the interest rate on the original mortgage. To insure that the relocation does not impose a financial burden on the relocated homeowner, special compensation is made to offset the increase in interest rates. No compensation is required if there is no increase in interest rates or if the acquired property is not encumbered by a bona fide mortgage.

Given the amount remaining on the original mortgage, the number of monthly payments remaining, the original mortgage interest rate and the mortgage interest rates in effect in the year of the relocation, the increased interest cost is calculated as follows:

(2) $$I = \frac{A-B}{C} D$$

where: I = Increased interest cost
A = Monthly payment based on new interest rate
B = Monthly payment based on original interest rate
C = Monthly payment based on passbook savings interest rate
D = Outstanding balance on old mortgage.

This formula and those used to calculate the monthly payments are presented in Appendix F.

The year in which the homeowner purchased his home, and the interest rate in effect in that year, are crucial to the determination of increased interest cost. Some homes in the relocation area for "Anytown U.S.A." may have been purchased recently at relatively high interest rates. Others may have been purchased long ago at the low interest rates prevailing at that time. This complex reality may be approximated with a single

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*The Relocation Act's $15,000 limit on replacement dwelling has not been raised in 10 years, even in the face of rapidly escallating housing values during this period. However, Federal agency experience under the Act is that payments generally do not exceed this limit. This situation may have changed in the last few years due to the extremely high interest rates.

representative case. Specifically, it is assumed that the home worth $62,187 in 1979 was purchased ten years earlier, when prices were 0.49 in the 1979 levels, or $30,471.63 (see Table 3.6). The home was purchased with ten percent down so that the original mortgage was for $27,424.47. The mortgage was a twenty-five year mortgage so that fifteen years remain in 1979. Because this case is intended to be representative of all homeowners, the actual mortgage interest rates prevailing in the year of purchase (7.80 percent) or in the year of sale (10.77 percent) are not used. Instead, rates are used from which the unwanted year to year fluctuations have been removed. These "smoothed out" interest rates better represent the linear trend in interest rates over the twenty-five year period, 1955-1979.

The time series data for this period are listed in Table 4.2 plotted in Figure 4.1. Also shown in Figure 4.1 is the least square line fitting the data. This line is used to estimate the trend-line mortgage interest rates for the historical period.

The estimated interest rates in 1969 and 1979 are 7.58 and 9.54 percent, respectively. Given the estimated 1969 mortgage interest rate, the mortgage amount of $27,424.47 and the 25 year term of the mortgage, the monthly payment is $204.09 and the balance remaining in 1979 is $21,907.77. The monthly payment at the passbook savings interest rate of 5-1/4 percent is $176.12. Using Equation (2), the increased interest cost is $3,134.66.

Closing Costs

Closing costs are incurred by all persons making a home purchase. In 1979 the Department of Transportation reports that closing costs associated with relocation averaged $400 per unit. Closing costs are low because the relocation agency provides guarantees to lending institutions and acts, to some extent, as legal representative for the relocated households. Also, all households participating in the relocation program are typically exempt from all taxes associated with the sale of their original units and the purchase of the replacement units.

Downpayment

The Federal Relocation Act has a special provision designed to assist tenants in becoming homeowners. Specifically, $2000 is available

outright to tenants for use as a downpayment and an additional $2000 is available on a matching basis. We assume that each tenant electing this option has at least $2000 to put toward a downpayment and, therefore, is eligible for the full $4000 downpayment allowance.

Income Foregone

Landlords typically suffer a disruption of their business operations and loose their existing tenants in the course of the relocation. However, the replacement properties which they purchase are typically occupied at the time of purchase. Under the Federal Relocation Act, owners of multiple unit structures receive the difference in gross annual earnings, if any. The owners of such units are also entitled to compensation for moving costs, up to $1,000, and search costs, up to $500.

Owners of single unit rental strutures who purchase comparable replacement structures are entitled to receive as compensation an amount equal to their average annual net earnings from their original rental property, if not less than $2500 nor more than $10,000. This payment is in lieu of moving costs and search costs.

For simplicity, we assume that all owners of single unit rental property receive an amount equal to their average annual net earnings. Furtheremore, we assume that net earnings equal three-quarters of gross earnings. The mean rental income in 1979 is $2,860.80 per unit per year. The net rental income is seventy-five percent of this, or $2,145.60 per single unit rental property.

The owners of multi-unit rental property receive a flat payment of $1,500 plus compensation for loss in gross earnings. It is assumed that such owners experience no loss in gross annual earnings and therefore receive $1,500. This payment is made without regard to the number of rental units in their buildings.

To place this cost on a per-rental property basis, the distribution of rental units among single and multi-unit structures must be known. The estimated distribution of rental units is given in Table 3.3 in the previous section. There it is shown that approximately three-quarters of all rental

TABLE 6.3
ACTUAL AND ESTIMATED MORTGAGE
INTEREST RATES FOR THE YEARS 1955-1979

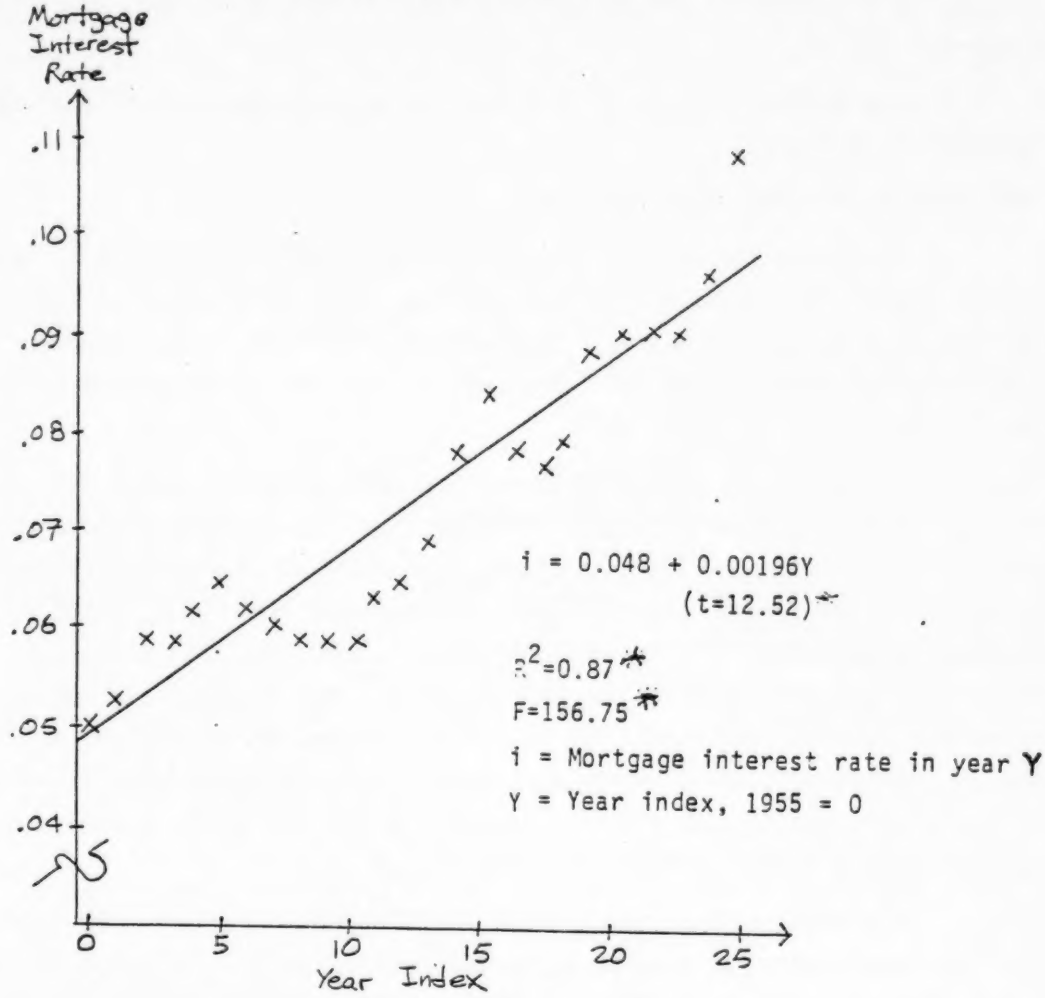
YEAR	YEAR INDEX	ACTUAL RATE	ESTIMATED RATE
1955	0.0	0.0500	0.0483
1955	1.0	0.0530	0.0503
1957	2.0	0.0590	0.0523
1958	3.0	0.0580	0.0542
1959	4.0	0.0620	0.0562
1960	5.0	0.0640	0.0581
1961	6.0	0.0610	0.0601
1962	7.0	0.0600	0.0621
1963	8.0	0.0589	0.0640
1964	9.0	0.0582	0.0660
1965	10.0	0.0851	0.0680
1966	11.0	0.0625	0.0699
1967	12.0	0.0646	0.0719
1968	13.0	0.0697	0.0738
1969	14.0	0.0780	0.0758
1970	15.0	0.0845	0.0778
1971	16.0	0.0774	0.0797
1972	17.0	0.0760	0.0817
1973	18.0	0.0795	0.0836
1974	19.0	0.0892	0.0856
1975	20.0	0.0901	0.0876
1976	21.0	0.0899	0.0895
1977	22.0	0.0901	0.0915
1978	23.0	0.0954	0.0934
1979	24.0	0.1077	0.0954

Source: 1955-1962, The Data Resources U.S. Long-Term Review, Winter 1977, Data Resources, Inc., "Housing," pages 11.10 - 11.11

1963-1979, Economic Report of the President, Transmitted to the Congress, January 1980, Table 64, page 278

FIGURE 6.2

SCATTER DIAGRAM OF MORTGAGE INTEREST RATES AND THE LEAST SQUARES REGRESSION LINE, 1955-1979



* The F statistic and student's t statistic indicate that the regression and the coefficient of the year index are quite significant. The R^2 indicates that the regression accounts for 87 percent of the variance in mortgage interest rates over time.

properties in "Anytown, U.S.A.," are single unit properties and one-quarter are multi-unit properties. Thus, the average income foregone per rental property is 3/4 times $2,145.60 plus 1/4 times $1,500, or $1,983 per rental property.

The procedures used in this section are presented in mathematical notation in Appendix D.

SUMMARY OF RELOCATION COSTS PER CASE

Estimates for 1979 of all cost elements for "Anytown, U.S.A." appear in Table 4.3. Costs are divided into two parts to distinguish those cost elements subject to maximums in the Relocation Act. A comparison of the latter cost elements to the Act's maximums is provided at the bottom of the table.

In Table 3.5, case frequencies were presented. In Table 4.3, costs per case were summarized. Table 4.4 brings these two elements together to arrive at an estimate of the total relo-ation cost. This estimate of total relocation costs assumes that everyone residing within a circle six miles in diameter somewhere in the imaginary "Anytown, U.S.A." would be exposed to airport noise levels exceeding L_{dn} 75 and would, therefore, be offered relocation assistance. Even given this broad assumption on impacted population, the cost estimate is in no way indicative of the costs potentially associated with an airport relocation effort undertaken in the context of a more comprehensive airport noise abatement planning program.

The costs also do not reflect the substantial reduction in noise exposure levels which will occur as a result of the control of noise at the source (the aircraft) currently required by Federal Aviation Administration regulations. The benefits of FAA's source regulations have been estimated by the Environmental Protection Agency in its recent report entitled "Aviation Noise: The Next Twenty Years". EPA estimated that population exposed to L_{dn} 75 or greater would be reduced from 300 thousand in 1980 to 100 thousand by the year 2000, a two-thirds reduction. The relocation cost implications of source control are approximated in T ble 4.4 by reducing the case frequencies to one third their former levels. Total costs are estimated to be $399 million without source control and $133 million with source control. Noise exposure

TABLE 4.3

ESTIMATES OF RELOCATION COSTS PER CASE IN THE YEAR 1979,
"ANYTOWN, U.S.A." (Dollars)

COST ELEMENT	RELOCATION CASE			
	A	B	C	D
Advisory Service Cost	1,200	1,200	1,200	1,200
Moving Cost	500	500	-	500
Purchase Price	-	-	118,288	62,187
Sub-Total I	1,700	1,700	119,488	63,887
Replacement Cost	1,144	-	-	6,219
Increased Interest Cost	-	-	-	3,135
Closing Cost	-	-		400
Downpayment	-	4,000	-	-
Income Foregone	-	-	1,983	-
Sub-Total II	1,144	4,000	1,983	9,754
TOTAL	$2,844	$5,700	$121,471	$73,641
LIMITS OF ACT				
Sub-Total II	1,144	4,000	1,983	9,754
Limits of Act	4,000	4,000	10,000	15,000
Costs in Excess of Limits	0	0	0	0

TABLE 4.4

TOTAL COST OF RELOCATING ALL RESIDENTS WITHIN A CIRCLE SIX MILES IN DIAMETER IN "ANYTOWN, U.S.A." 1979

COST ELEMENT	RELOCATION CASE*			
	A	B	C	D
WITHOUT AIRCRAFT SOURCE CONTROL				
Frequency	3,516	670	1,093	3,302
Cost per Case ($)	$ 2,844	$5,700	$121,471	$73,641
Total ($ Million)	$ 10.00	$3.82	$132.77	$243.16
Grand Total ($ Million)	$389.75			
WITH AIRCRAFT SOURCE CONTROL				
Frequency	1,172	223	364	1,101
Cost per Case ($)	$ 2,844	$5,700	$121,471	$73,641
Total ($ Million)	$ 3.33	$1.27	$44.26	$81.05
Grand Total ($ Million)	$129.92			

*Relocation Cases

A. Renters Who Remain Renters
B. Renters Who Become Homeowners
C. Rental Property to be Purchased
D. Owner-Occupied Units to be Purchased

level reductions resulting from other actions, such as preferential runway use, nighttime curfews, and modified flight tracks and procedures would further lower total estimated relocation costs.

APPENDIX A

ESTIMATES OF THE NUMBER OF RENTAL UNITS AND SINGLE-UNIT AND MULTI-UNIT RENTAL PROPERTIES, "ANYTOWN, U.S.A." 1970

APPENDIX A

ESTIMATES OF THE NUMBER OF RENTAL UNITS AND SINGLE-UNIT AND MULTI-UNIT RENTAL PROPERTIES, "ANYTOWN, U.S.A." 1970

The procedure developed in Chapter III to determine the frequency of relocation cases relies almost exclusively on Demographic Profile Reports, an abstract of which for "Anytown, U.S.A." is presented in Table 3.2. Much of the needed information may be obtained directly from the reports. Other information (i.e. regarding the number of: (1) total rental units; (2) total rental properties; (3) single-unit rental properties; and (4) multi-unit rental properties) may be obtained indirectly from the Demographic Profile Reports using the procedure described below.

This estimating procedure is simplified by the fact that all data on homeowners appearing in the Demographic Profile Report apply only to owners of single family dwellings.

Three assumptions further simplify the analysis. These are:

(1) The average number of units in a structure is the midpoint of the range given on the CACI Demographic Profile.

(2) All vacant units are rental units.

(3) Each landlord owns a single rental structure so that the number of structures equals the number of "properties".

These are simplifying assumptions and may not accurately reflect the disposition of structures around a particular airport. In the absence of airport specific information these simplifying assumptions provide estimates which are adequate for costing purposes.

Table A.1, following, serves as a worksheet for applying these assumptions and deriving the needed estimates.

Step 1 Estimate the number of structures (Column 4)

Step 2 Estimate the number of rental units (Row 3)

Step 3 Estimate the number of single-unit rental structures (Row 6)

Step 4 Estimate the number of multi-unit structures (Row 7)

Step 5 Estimate the total number of rental structures (Row 8)

TABLE A.1

WORKSHEET FOR ESTIMATING THE NUMBER OF RENTAL UNITS AND SINGLE-UNIT AND MULTI-UNIT RENTAL PROPERTIES

		(1) Units in Structure		(3)	(4)
		Range	Average	Number of Units	Number of Structures
		1	1.0	4,086	4,086.00
		2	2.0	81	40.50
		3-4	3.5	305	87.14
		5-9	7.0	579	82.71
		10-49	29.5	1,445	48.98
		50+	75.0	1,055	14.07
(1)	TOTAL			7,551	4,359.40
	RENTAL UNITS:				
(2)	Homeowners			3,275	
(3)	Units Available for Rental			4,276	
	RENTAL STRUCTURES:				
(4)	Single Unit Structures				4,086.00
(5)	Homeowners				3,275.00
(6)	Single-unit Structures Available for Rental				811.00
(7)	Multi-unit Structures				273.40
(8)	Total Number of Rental Structures				1,084.40

Notes applying to columns:

(4) = (3)/(2)

Notes applying to rows:

(3) = (1)-(2)
(6) = (4)-(5)
(7) = (1)-(4)
(8) = (6)+(7)

APPENDIX B

SUMMARY OF RELOCATION EXPERIENCE OF THE FEDERAL HIGHWAY ADMINISTRATION, OCTOBER 1, 1978 TO SEPTEMBER 30, 1979*

APPENDIX B

SUMMARY OF RELOCATION EXPERIENCE OF THE FEDERAL HIGHWAY ADMINISTRATION, OCTOBER 1, 1978

1. Summary of Residential Displacements, Owner-Tenant Status, for the period October 1, 1978 to September 30, 1979.

Number of Tenants	2473
Number of Owners	2345
Total Residential	4818

2. Summary of Service Costs, for the period October 1, 1978 to September 30, 1979. (Sec. 205)**

Number of Claims	6384
Average Amount	$1203

3. Summary of Moving Payments, Residential Units, for period October 1, 1978 to September 30, 1979. (Sec. 202)

Actual Cost	
Number of Claims	678
Average Amount	$1162
Fixed Cost	
Number of Claims	3557
Average Amount	$ 418
Total Number of Claims	4235
Average Amount	$ 537

*Source: Office of Right-of-Way, Federal Highway Administration, Department of Transportation, Personal Correspondence, January 23, 1981.

**Includes services to displaced businesses.

4. Summary of Replacement Housing Payments to Owners, 180 Days or More, for the period October 1, 1978 to September 30, 1979. (Sec. 203)

Housing Differential (Replacement Cost)	
Number of Claims	82
Average Amount	$2334
Increased Interest Cost	
Number of Claims	387
Average Amount	$2989
Closing Costs	
Number of Claims	1324
Average Amount	$ 372

5. Summary of Replacement Housing Payments to Tenants, for the period October 1, 1978 to September 30, 1979. (Sec. 204)

Downpayments for Tenants	
Number of Claims	387
Average Amount	$2894
Closing Costs for Tenants	
Number of Claims	187
Average Amount	$ 224
Rental Payments	
Number of Claims	1325
Average Amount	$2706

6. Ratio of Number of Tenants Who Become Homeowners to Total Tenants

Number of Claims for Downpayment	387
Number of Tenants (See Number 1, above)	2473
Ratio	0.16

APPENDIX C

EQUATIONS USED TO CALCULATE CASE FREQUENCIES

APPENDIX C
EQUATIONS USED TO CALCULATE CASE FREQUENCIES

SYMBOLS

N_t = Number of households in year t

g = Compound annual growth rate

t = Year index which equals zero in 1970. In calendar year other than 1970, the value of the year index is the calendar year minus 1970 (e.g. in 1980 t = 10 because 1980 - 1970 = 10)

H_t = Number of occupied housing units in year t

R_t = Number of renters in year t

A_t = Number of renters who remain renters in year t (Case A)

$\bar{a}$ = Proportion of renters who remain renters; a constant
= 0.84

B_t = Number of renters who become homeowners in year t (Case B)

$\bar{b}$ = Proportion of renters who become homeowners; a constant
= 0.16

D_t = Number of owner-occupied units in year t (Case D)

U_t = Number of housing units in year t

u_t = Number of rental units in year t

C_t = Number of rental structures in year t (Case C)

EQUATIONS

(1) Households

$$N_t = N_0 (i + g)^t$$

For "Anytown" the profile shows the number of households in 1970 and in 1980. This information is used to solve for the compound annual growth rate as follows:

$$N_{10} = N_0 (1 + g)^{10}$$

$$g = \left[\frac{N_{10}}{N_0}\right]^{1/10} - 1$$

$$= \left[\frac{7617}{7549}\right]^{1/10} - 1 = 0.000897$$

The number of households in 1979 is

$$N_9 = N_0 (1 + g)^9$$

$$= 7549 (1.000897)^9 = 7610.2$$

(2) Occupied Units

$$H_t = \frac{H_o}{N_o} N_t$$

(3) Renters

$$R_t = \frac{R_o}{H_o} H_t$$

(4) Renters Who Become Homeowners (Case A)

$$A_t = \bar{a} R_t$$

(5) Renters Who Become Homeowners (Case B)

$$B_t = \bar{b} R_t$$

(6) Owner-Occupied Units (Case D)

$$D_t = \frac{D_o}{H_o} H_t$$

(7) Housing Units

$$U_t = \frac{U_o}{H_o} H_t$$

(8) Rental Units

$$u_t = U_t - D_t$$

(9) Rental Properties (Case C)

$$C_t = \frac{C_o}{u_o} u_t$$

APPENDIX D

EQUATIONS USED TO CALCULATE PURCHASE PRICES REPLACEMENT COSTS AND INCOME FOREGONE

APPENDIX D

EQUATIONS USED TO CALCULATE PURCHASE PRICES
REPLACEMENT COSTS AND INCOME FOREGONE

SYMBOLS

R = Rent per unit in year of relocation (dollars per month)

R_o = Rent per unit in 1970 (dollars per month)

r = Price index for residential rent in the year of relocation, $r = 1.60$ in 1979. See Table 3.6.

Y = Yearly rental income per unit in year of relocation (dollars per year)

C = Value per rental property in year of relocation (dollars)

U = Average number of units per rental property, $U = 3.9446$ in "Anytown"; see Table 3.4.

i = Estimated mortgage interest rate in year of relocation, $i = 0.0954$ in 1979. See Table 3.7.

D = Value per owner-occupied unit in year of relocation (dollars)

D_o = Value per owner-occupied unit in 1970 (dollars)

d = Price index for home purchase in the year of relocation, $d = 1.89$ in 1979. See Table 3.6.

a = Replacement cost per renter in year of relocation

b = Replacement cost per homeowner in year of relocation

s = Single unit rental properties as a proportion of all rental properties

m = Multi-unit rental properties as a proportion of all rental properties

F = Foregone income from rental property

EQUATIONS

(1) $R = r\ 4R_o$

(2) $Y = 12R$

Purchase Prices

(3) $C = YU/i$

(4) $D = dD_o$

Replacement Costs

(5) $a = .10\ (4Y)$

(6) $b = .10D$

Foregone Income (See text)

(7) $F = s\ (.75)\ Y + m\ (1500)$

EXAMPLE: "Anytown, U.S.A."

Parameters

$R_o = \$149$

$r = 1.60$

$U = 3.9446$

$i = 0.0954$

$D_o = \$32,903$

$d = 1.89$

$s = 0.7482$

$m = 0.2518$

VARIABLES

$R = (1.60)\ (149) = \$238.40$

$Y = 12(238.40) = \$2,860.80$

$C = (2860.80)\ (3.9446)/0.0954$

$= 11,284.71/0.0954 = \$118,288$

$D = (1.89)\ (32,903) = \$62,187$

$a = (.10)\ (4)\ (2860.80) = \$1,144$

$b = (.10)\ (62,187) = \$6,219$

$F = (0.7482)\ (.75)\ (2860.80) + (0.2518)\ (1500)$

$= 1605.34 + 377.70 = \$1,983$

APPENDIX E

AIRPORT NOISE AND RESIDENTIAL PROPERTY VALUES; A SUMMARY OF RECENT EVIDENCE

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AIRPORT NOISE AND RESIDENTIAL PROPERTY VALUES; A SUMMARY OF RECENT EVIDENCE

A recent literature search conducted by Informatics, Inc. for the U.S. Environmental Protection Agency states that "an excellent review of the aircraft noise / property value literature was written by J. P. Nelson [in 1980]. This review is the only extensive literature review we located."* ORI's literature search indicates that the situation has not changed since 1980. The referenced article was written by Jon P. Nelson, Professor of Economics at the Pennsylvania State University and Researcher at the University's Institute for Policy Study. Professor Nelson has a thorough command of the relevant economics literature and is a principle researcher in the area. He is the author of six studies on the effects of airport noise on residential property values.

The conclusion from his review of the aircraft noise/property value literature follows:

> To date, some thirteen empirical studies of airport noise and property values have been conducted using cross-sectional housing data. These studies are consistent with or based on the hedonic price model. The estimated coefficient for noise exposure is the marginal implicit damage per decibel of noise or the marginal implicit price per decibel of noise avoided.

*C. Modig and D. Barber, Trends in the Literature on: The Effects of Aircraft and Traffic Noise on Residential Property Values, October 1980, Informatics, Inc., Rockville, MD., page 11.

Households can be assumed to locate themselves in space so that differences in values of residential properties are equalising only at the margin. That is, if two houses have different noise environments and are otherwise identical, the difference in value is the expected discounted present value of noise annoyance. Evaluation of the marginal implicit price function over the range of noise exposures and property values produces a locus of equilibrium outcomes that reflect both demand and supply forces. While this locus of values is not a marginal valuation function, benefit estimation can be conducted if the change in noise exposure levels is small and if partial equilibrium assumptions can be assumed to hold.

A survey of evidence from thirteen studies suggests noise discounts in the range of 0.4 to 1.1% per decibel. Noisy and quiet properties will differ by at least 20 decibels of noise exposure. Thus, a $40,000 house would sell for $32-36,000 if located in a noisy zone, or at a total discount of 10-20%. The evidence reviewed further, suggests that the noise discount is commonly 0.5-0.6%, though a higher value may occur in some high-income areas (Boston, Washington, D.C., London, for example). While none of the studies reviewed are completely free of error or bias, the weight of the evidence is consistent with the orthodox economic theory of land rents. For broad policy decisions on noise abatement alternatives, order-of-magnitude or lower bound estimates based on property value data may be quite valuable to decision makers.**

**Jon P. Nelson, "Airports and Property Values: A Survey of Recent Evidence", Journal of Transport Economics and Policy, January 1980, pages 37-52. Conclusion appears on pages 45-46.

APPENDIX F

EQUATIONS USED TO CALCULATE INCREASED INTEREST COST

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EQUATIONS USED TO CALCULATE INCREASED INTEREST COST

Symbols

V_t = Value of property in year t, year t is assumed to be the year of relocation (dollars)

t = Year index which equals zero in 1979. In calendar years other than 1970, the value of the year index is the calendar year minus 1979 (e.g., in 1969 t = -10 because 1969 - 1979 -10)

v_t = Price index which converts values in base year to values in year t (see Table 4.1 in text)

V_o = Value of property in base year, 1979 (dollars)

V_{t-10} = Value of property ten years prior to year t; year t -10 is assumed to be the year of purchase (dollars)

M = Amount of original mortgage (dollars)

x = Downpayment expressed as a proportion of the purchase price; downpayment is assumed to be ten percent expressed as 0.10

B = Monthly payment on original mortgage (dollars/month)

i = Interest rate on original mortgage expressed as a decimal to six places and as a monthly rate (e.g., 6% is expressed as 0.06/12 = 0.005000 per month)

Symbols

n = Number of monthly payments on the original mortgage (e.g., 25 years is expressed as 25 x 12 = 300)

D = Unpaid balance on original mortgage at time of relocation (dollars)

m = Number of monthly payments remaining on original mortgage at time of relocation

A = Monthly payment required to pay off D at interest rate r in m months (dollars/month)

r = Interest rate at time of relocation expressed as a decimal to six places and as a monthly rate (see i above)

c = Monthly payment required to pay off D at interest rate p in m months (dollars/month)

p = Interest rate on local passbook saving bank at time of relocation expressed as a decimal to six places and as a monthly rate. The passbook savings rate is currently 5.25 percent per year which is expressed as 0.0525/25=0.004375 per month.

EQUATIONS

(1) $V_t = v_t V_o$

(2) $V_{t-10} = v_{t-10} V_o$

(3) $M = (1-x)\ V_{t-10}$

(4) $B = Mb$ where $b = i/\{1-(1+i)^{-n}\}$

(5) $D = Bd$ where $d = \{1-(1+i)^{-m}\}/i$

(6) $A = Da$ where $a = r/\{1-(1+r)^{-m}\}$

(7) $C = Dc$ where $c = p/\{1-(1+p)^{-m}\}$

(8) $I = (A-B)/c$

From (7) it follows that

$\frac{C}{D} = c$

Therefore (8) can be expressed as

(9) $I = \{(A-B)/C\}\ D$

Equation (9) appears in the text as Equation (2).

EXAMPLE: "Anytown, U.S.A."

Parameters

$V_o = (1.89)\ (32,903) = \$62,187$ (See Table 4.1)

t = 0, i.e., the year of relocation is the base year 1979

$V_{t-10} = 0.49$ (From Table 4.1)

x = 0.10

i = 7.58% expressed as 0.0758/12 = 0.006317 per month, from Table 4.2

n = 25 years x 12 = 300 months

m = 15 years x 12 = 180 months

r = 9.54% per year expressed as 0.0954/12 = 0.007950 per month, from Table 4.2

p = 5.25% per year expressed as 0.0525/12 = 0.004375 per month

Variables

(1) $V_t = \$62,187$

(2) $V_{t-10} = (0.49)\ (62,187) = \$30,471.63$

(3) $M = (1-0.10)\ (30,471.63) = \$27,424.47$

(4) $b = 0.007442$

$B = (27,424.47)\ (0.007442) = \$204.09$

(5) $d = 107.343695$

$D = (204.09)\ (107.343695) = \$21.907.77$

(6) $a = 0.010466$

$A = (21,907.77)\ (0.010466) = \$229.29$

(7) $c = 0.008039$

$C = (21,907.77)\ (0.008039) = \$176.12$

(9) $I = \{(229.29 - 204.09)/176.12\}\ (21,907.77)$

$= (0.143084)\ (21,907.77) = \$3,134.66$